REMARKS

This is a full and timely response to the Office Action mailed April 1, 2009, submitted concurrently with a two month extension of time to extend the due date for response to September 1, 2009.

By this Amendment, the specification and claim 1 have been amended to address the rejections under 35 U.S.C. §112. Thus, claims 1-5 are currently pending in this application, with claim 5 being withdrawn. Support for the amendments to the specification and claims can be readily found variously throughout the specification and the original claims, see, in particular, page 5, lines 25-26, and page 15, line 15, of the specification.

In view of these amendments, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

Preliminary Notice

The Examiner has requested additional clarification regarding the derivation of Equation (5) (i.e. Formula (1) of claim 1). Applicant has provided for the Examiner's information the following detailed explanations of variables A, B, and Equation (5).

Specifically, as explained in paragraph [0017] of the present Patent Application Publication 2005/0150254 A1, when an object is irradiated in a vacuum by light of a wavelength λ_0 and an intensity I_0, the intensity I at a depth z is $I_0\exp(-\alpha z)$. A is the percent of laser light *absorbed* within the Sample S of thickness d (see paragraph [0018] of the present Patent Application Publication 2005/0150254 A1). Thus, $A/100 = (I_0-I)/I_0$ and the intensity I at depth d is $I_0\exp(-\alpha d)$, as shown in Equation (1). Substituting in this definition of I results in $A/100 = (I_0-I_0\exp(-\alpha d))/I_0$. Rearrangement of this equation results in $\exp(-\alpha) = ((100-A)/100)^{1/d}$.

B, on the other hand, is the percent of *transmittance* when a brittle material W of a thickness D is irradiated by light of the same wavelength. Thus $B/100 = I'/I_0$, where I' is an emitted light intensity at a thickness D (see paragraph [0019] of the present Patent Application Publication). Substituting in $I_0\exp(-\alpha D)$ for I' results in $B/100 = \exp(-\alpha D)$.

Thus, the equation in claim 1 is correctly derived from the above equations. For example, $\exp(-\alpha) = ((100-A)/100)^{1/d}$, so it follows that $\exp(-\alpha D) = ((100-A)/100)^{D/d}$. Further, $B/100 = \exp(-\alpha D)$, so it follows that $B/100 = ((100-A)/100)^{D/d}$. Rearrangement of this equation results in $A = 100 - (100)^{D/d} B^{d/D}$, as recited in claim 1.

Applicant believes that the above explanation addresses the Examiner's concerns.

Rejections under 35 U.S.C. §112

Claims 1-5 are rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement. Further, claims 1-5 are rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicant believes that the amendments to the specification and claim 1 overcome these rejections by (1) clarifying that (B) is the transmittance of the brittle material and deleting the term "*predetermined*," (2) replacing the term "*near*" with the phrase "*closest to*," (3) changing the phrase "*the absorptance of a brittle material*" to "***an*** *absorptance of a brittle material*," (4) deleting the phrase "*based on a set value of absorptance and a thickness of the plate-shaped sample*," and (5) amending line 3 of claim 1 to "*irradiating a light onto a plate-shaped sample with a plurality of wavelengths to obtain actual absorptance data*" and adding the term "*said*" in line 7 of claim 1.

Thus, in view of the amendments to the specification and claim 1, withdrawal of these rejections is respectfully requested.

Rejection under 35 U.S.C. §103

Claims 1-4 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Smart (U.S. Patent No. 6,337,462 B1). Applicant respectfully traverses this rejection.

To establish an obviousness rejection under 35 U.S.C. §103(a), four factual inquiries must be examined. The four factual inquiries include (a) determining the scope and contents of the prior art; (b) ascertaining the differences between the prior art and the claims in issue; (c) resolving the level of ordinary skill in the pertinent art; and (d) evaluating evidence of secondary consideration. *Graham v. John Deere*, 383 U.S. I, 17-18 (1966). In view of these four factors, the

analysis supporting a rejection under 35 U.S.C. 103(a) should be made explicit, and should "identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the [prior art] elements" in the manner claimed. *KSR Int'l. Co. v. Telefex, Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385, 1396 (2007). Further, the Federal Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). Finally, even if the prior art may be combined, there must be a reasonable expectation of success, and the reference or references, when combined, must disclose or suggest all of the claim limitations. *See in re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In this case, Applicant submits that the Examiner has failed to establish a *prima facie* case of obviousness because the combined prior art fails to disclose or suggest all of the claim limitations with particular emphasis on the limitations "*wherein the optimum wavelength of light permits a region of an internal material portion of the brittle material and the surface vicinity of the brittle material to become an absorbing region by the irradiation of the light onto the brittle material*", "*wherein the optimum wavelength of light allows for the generation of an uniform heating band in the thickness direction and the formation of cracks deep in the internal portion of the brittle material*", "*wherein the absorptance (A) of the plate-shaped sample is calculated by Formula (I),*

$$A = 100 - (100)^{D/d} B^{d/D} \qquad (I),$$

based on a thickness (D) of the brittle material to be processed, the thickness (d) of the plate-shaped sample, and a transmittance of the brittle material (B)," and "*wherein the light source is made to emit the light having the optimum wavelength such that the actual absorptance of the plate-shaped sample is closest to the calculated absorptance (A).*"

The present invention is characterized in that a laser light source for performing laser processing on a material to be processed using laser light of desired transmittance is selected according to the thickness D of the material to be processed based on the thickness d of a sample that is made of the same material as the material to be processed and an actual absorptance value with respect to the sample.

Although Smart discloses relationships between absorptances and wavelengths, Smart never discloses selecting a wavelength or a light source *to achieve absorptance of a desired value according to the thickness of the substrate*. Rather, Smart discloses that using a laser beam of the wavelength beyond an absorption edge (longer than the absorption edge) and shorter than 1.2 μm circumvents damage to the substrate (see column 6, lines 1-25, of Smart), but fails to disclose or suggest that the wavelength of the laser beam *is selected according to the thickness of the substrate*.

The Examiner asserts that the calculation of absorptance based upon Formula (I) would have been obvious to one of ordinary skill in the art because Formula (I) is derived from the Beer-Lambert Law, which is well known (see pages 11-12 of the Office Action). However, the prior art does not teach or suggest performing a calculation according to Formula (I). Further, the Beer-Lambert Law merely provides a logarithmic relationship between the transmission of light through a substance and the product of the absorption coefficient of the substance, and the distance the light travels through the material. The present invention employs this relationship, but goes further by calculating the absorptance of a plate-shaped sample using the thickness of a brittle material to be processed, the thickness of the plate-shaped sample, and a transmittance of the brittle material, and then selecting an optimum wavelength of light for an absorptance of a brittle material to be processed based on the calculated value of absorptance, and actual absorptance data obtained. In contrast, Smart merely uses the Beer-Lambert Law to demonstrate that a very slight change in wavelength results in a drastic change in absorption. Thus, the prior art does not teach or suggest employing the Beer-Lambert Law in the claimed manner.

In addition, Applicant disagrees with the Examiner's comments relating to the use of the terms "*permits*" and "*allows*," because one of ordinary skill in the art would not have been motivated to modify Smart to select an optimum wavelength that would allow/permit for the features of the present invention. As noted in the previous response, the main purpose of Smart is to shift the wavelength of the laser output from a conventional wavelength to a wavelength *beyond the absorption edge of the substrate to minimize thermal processing damage to the substrate*, so selecting an optimum wavelength of light to allow for *the generation of an* ***uniform heating band*** *in the thickness direction and the formation of cracks deep in the internal portion of the brittle material* would conflict with the main purpose of Smart.

Further, Applicant disagrees with the Examiner's argument that there is no reasoned basis to suggest that the prior art disclosed process is in any manner patentably distinguishable from the claimed invention. As noted in the last response, the claimed process possesses unexpected and superior properties as compared to the prior art because it provides for the brittle material to be heated in the surface vicinity *substantially simultaneously* to the heating of the internal material portion thereby allowing the necessary temperature increase to be obtained within a short time, thereby *greatly accelerating the processing speed* of the brittle material.

Thus, for these reasons, withdrawal of the present rejection is respectfully requested.

CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

Dated: September 1, 2009

Respectfully submitted,

By: 

Lee Cheng
Registration No.: 40,949
CHENG LAW GROUP, PLLC
1100 17th Street, N.W.
Suite 503
Washington, DC 20036
(202) 530-1280
Attorney for Applicant

Should additional fees be necessary in connection with the filing of this paper, or if a petition for extension of time is required for timely acceptance of same, the Commissioner is hereby authorized to charge Deposit Account No. 50-4422 for any such fees; and applicant(s) hereby petition for any needed extension of time.